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U. S. DEPARTMENT OF AGRICULTURE.

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WHEAT AS A FOOD FOR GROWING AND FATTENING ANIMALS.

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During the past year there have been numerous inquiries in regard to the chemical composition of wheat as compared with corn and oats, its relative value as a food for growing and fattening animals, and the method of feeding which would produce the best results. These inquiries have, doubtless, been suggested by the great change in the comparative prices of the grains just mentioned. In the past we have been accustomed to see a bushel of wheat sell for two or three times as much as a bushel of corn. Recently we have seen 56 pounds of corn sell for more than could be obtained for 60 pounds of wheat. This readjustment of the prices of grain evidently calls for a reconsideration of the methods for disposing of the cereal crops in order to determine which is most profitable under present conditions.

The purpose of this circular is to give a direct and definite answer to the questions which have been most frequently asked concerning the use of wheat as a food for stock.

The quantity and proportion of the different proximate constituents which are present in a digestible form in 100 pounds of some of the common feeding stuffs is compared in the following table with the German feeding standards.

This table presents the chemical aspect of the subject, and is valuable in the indications and suggestions which may be obtained from it. The information which it contains should, however, be used in connection with our knowledge of the habits of animals and the practical results of feeding. We should not care to assert, for instance, that wheat screenings are in general more valuable as a food for animals than the plump, sound wheat, although the table would indicate this to be the case. We may, however, safely conclude that the screenings and imperfect wheat should be fed and only the best wheat put upon the market.

Table showing digestible components in 100 pounds of feeding stuff and the nutritive ratio; also feeding standards.*

	Protein.	Carbohy- drates.	Fat.	Nutritive ratio.
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	
Wheat.....	9.3	55.8	1.8	1: 6.4
Corn (maize).....	7.1	62.7	4.2	1: 10.1
Rye.....	8.3	65.5	1.2	1: 8.3
Oats.....	9.1	44.7	4.1	1: 5.9
Peas.....	18.0	56.0	0.9	1: 3.2
Wheat screenings.....	9.8	51.0	2.2	1: 5.7
Wheat middlings.....	12.2	47.2	2.9	1: 4.4
Wheat bran.....	12.6	44.1	2.9	1: 4.0
FEEDING STANDARDS.				
[Per day and per 1,000 pounds, live weight.]				
Horses, moderately worked.....	1.6	10.0	0.5	1: 7.0
Horses, heavily worked.....	2.5	12.1	0.7	1: 5.5
Growing cattle:				
Age 2 to 3 months; average live weight, 165 pounds.....	4.0	13.8	2.0	1: 4.7
Age 6 to 12 months; average live weight, 550 pounds.....	2.5	13.5	0.6	1: 6.0
Age 18 to 24 months; average liveweight, 940 pounds.....	1.6	12.0	0.3	1: 8.5
Fattening cattle:				
First period.....	2.5	15.0	0.5	1: 6.5
Second period.....	3.0	14.8	0.7	1: 5.5
Third period.....	2.7	14.8	0.6	1: 6.0
Growing pigs:				
Age 2 to 3 months; average live weight, 55 pounds.....	7.5	30.0		1: 4.0
Age 5 to 6 months; average live weight, 137 pounds.....	4.3	23.7		1: 5.0
Age 8 to 12 months; average live weight, 275 pounds.....	2.5	16.2		1: 6.5
Fattening swine:				
First period.....	5.0	27.5		1: 5.5
Second period.....	4.0	24.0		1: 6.0
Third period.....	2.7	17.5		1: 6.5

* The figures in these tables are taken from the article by Prof. W. A. Henry, on "The feeding and management of cattle," in the Special Report of the Bureau of Animal Industry on Diseases of Cattle.

It is seen that wheat contains practically the same amount of protein per 100 pounds as oats, and that both wheat and oats contain about 30 per cent more protein than corn. On the other hand, wheat only has about one-half as much fatty matter as corn and oats. In carbohydrates the position of wheat is about halfway between that of corn and oats.

Protein, that is the albuminoid constituents of grain, goes to build up the albuminoid tissues of the animal body of which the muscles are the most prominent part, but it may also be changed into fat. The fat in the animal body comes, therefore, both from the fat and the protein in the food which is eaten. The carbohydrates sustain the heat of the body and must be present in sufficient quantity or the more valuable fat which has already been assimilated will be used for this purpose. Young growing animals require more protein than older ones, and also more than fattening animals, in order to supply material for building up the muscles, tendons, and other albuminoid structures.

We must not conclude from these facts, as some have, that because wheat is particularly indicated for young growing animals it is not adapted for those which are fattening. The fallacy of such a conclusion is shown by the following comparisons:

	Protein.	Carbohy- drates.	Fat.	Nutritive ratio.
<i>First comparison.</i>				
Feeding standard:				
Growing cattle, 6 to 12 months old.....	2.5	13.5	1.6	1: 6.0
26.6 pounds wheat.....	2.5	15.0	0.5	1: 6.4
<i>Second comparison.</i>				
Feeding standard:				
Fattening cattle, second period.....	3.0	14.8	0.7	1: 5.5
33½ pounds wheat.....	3.1	18.6	0.6	1: 6.4
33½ pounds corn.....	2.4	20.9	1.4	1: 10.1

This table brings out in the clearest possible manner, first, the near approach chemically of 26.6 pounds of wheat to the German standard ration for growing cattle from 6 to 12 months of age, and, secondly, the fact that 33½ pounds of wheat comes much nearer the feeding standard for fattening cattle than does the same quantity of corn. The proportion of the protein to carbohydrates and to fat is very much nearer the standard in wheat than in corn. Tried by these standards wheat is better both for growing and fattening animals than is corn.

These standards, however, are not to be considered as perfect. Corn comes nearer being an ideal grain for fattening animals in this country than is indicated by the tables. Such animals apparently do not need as much protein as is contained in the standard, and may take with advantage more carbohydrates and fat. Equal parts of wheat and corn should, therefore, prove better for fattening animals than either of these grains alone. For growing animals corn is plainly not so suitable as is wheat or oats.

When wheat and corn are the same price per bushel, it is preferable to feed wheat and sell corn: First, because wheat weighs 7 per cent heavier per bushel than corn; secondly, because wheat is weight for weight an equally good grain for fattening animals, and better for growing animals; and thirdly, because there is much less value in fertilizing elements removed from the farm in corn than in wheat.

There are certain points to be borne in mind when one is commencing to feed wheat. Our domesticated animals are all very fond of it, but are not accustomed to eating it. Precautions should consequently be observed to prevent accidents and disease from its use. It is a matter of common observation that when full-fed horses are changed from old to new oats they are liable to attacks of indigestion, colic, and founder. If such results follow the change from old to new oats, how much more likely are they to follow a radical change, such as that from oats to wheat? For this reason wheat should at first be fed in small quantities. It should, when possible, be mixed with some other grain, and care should be taken to prevent any one animal from getting more than the quantity intended for it.

These precautions are especially necessary when wheat is fed to horses, as these animals are peculiarly liable to colic and other disturbances of the digestive organs, accompanied or followed by laminitis. Cattle, sheep, and hogs frequently crowd each other from the feeding troughs, in which case some individuals obtain more than their share, and may bring on serious or fatal attacks of indigestion.

The best form in which to feed wheat is to roll or grind it into a coarse meal. It may then be fed alone, or mixed with corn meal or ground oats. When ground fine it is pasty and adheres to the teeth, gums, and cheeks so that it is not so readily masticated or eaten. In the form of a coarse meal it is relished by all animals, it is in a condition to be attacked by the digestive processes whether thoroughly masticated or not, and in most cases it gives the best results. Dr. Gilbert appears to have obtained better results from whole than from ground wheat when fed to sheep. Sheep feeders may, therefore, experiment with whole wheat, but wheat meal will certainly be found to give better results with all other kinds of animals.

The number of pounds of live weight that may be produced by feeding a bushel of wheat will evidently vary according to the age and condition of the animal fed. Prof. Robertson, at the Ottawa experiment station, fed frozen wheat to hogs and secured from 9.1 to 15.46 pounds, live weight, from a bushel, the greater increase being from young, growing animals, and the smaller from those which were fattening.

At the South Dakota Experiment Station the hogs fed ground wheat required 4.81 pounds, and those fed whole wheat required 4.91 pounds for 1 pound gain in live weight. The ground wheat fed returned 58.39 cents per bushel, the whole wheat, 55.83 cents; corn, 60 cents; and peas, 65.36 cents. The quality of pork obtained from ground wheat and corn was about equal, and was superior to that from whole wheat, peas, or mixed feed.

From the Canadian experiments it would appear that the feeding value of an equal weight of wheat is slightly in excess of that of corn; the South Dakota experi-

ments gave better results from corn. In general, the difference would probably not be very great, but it would undoubtedly be better to mix corn and wheat, or corn, wheat, and bran, or corn, wheat, and middlings. The following examples show the composition of such mixtures:

	Protein.	Carbo- hydrates.	Fat.	Nutritive ratio.
Mixture No. 1:	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	
50 pounds corn.....	3.5	31.3	2.1	
50 pounds wheat.....	4.6	27.9	0.9	
100 pounds mixture.....	8.1	59.2	3.0	1:8.1
Mixture No. 2:				
40 pounds wheat.....	3.7	22.3	0.7	
40 pounds corn.....	2.8	25.1	1.7	
20 pounds bran.....	2.5	8.8	0.6	
100 pounds mixture.....	9.0	56.2	3.0	1:7.0
Mixture No. 3:				
40 pounds wheat.....	3.7	22.3	0.7	
20 pounds corn.....	1.4	12.6	0.8	
20 pounds oats.....	1.8	8.9	0.8	
20 pounds middlings.....	2.4	8.4	0.6	
100 pounds mixture.....	9.3	52.2	2.9	1:6.3
Mixture No. 4:				
60 pounds wheat.....	5.5	33.4	1.1	
20 pounds oats.....	1.8	8.9	0.8	
20 pounds middlings.....	2.4	8.4	0.6	
100 pounds mixture.....	9.7	50.7	2.5	1:5.8

Many other combinations might be made, but these are sufficient for purposes of illustration. Mixtures 1 and 2 are more suitable for fattening animals, while 3 and 4 are excellent either for growing animals or for those being fattened.